

The background of the slide is an aerial photograph of a landscape, possibly a forest or agricultural field, with a color gradient overlay. The gradient transitions from a deep red on the left side, through orange and yellow, to a bright green on the right side. The texture of the ground is visible, showing various shades of brown, tan, and green.

# **Unmanned Aerial Systems**

## **Drone Usage That Doesn't Make the Headlines**

**John Knowlton, CP, PMP, GISP**

January 20, 2016

# Highlights

- Nearly 100,000 employees operating in more than 150 countries
- US\$19.5 billion of revenue for the 12 months ending on September 30, 2014
- Currently No. 332 on the *Fortune 500* list
- Ranked by Ethisphere as one of the world's most ethical companies
- Recognized by the U.S. Chamber of Commerce's Business Civic Leadership Center as honoree for Best Corporate Stewardship



**AECOM designs, builds, finances, operates, and maintains the world's infrastructure**

**Drones Ruin  
Everything for  
Everybody, Nobody  
Should be Using  
Drones**

The background features several thin, light brown lines that intersect to form various geometric shapes, including triangles and quadrilaterals, creating a modern, abstract design.

## Unfortunate Drone Headlines

**Drone crashes near the White House**

**Drone "attack" on German Chancellor Angela Merkel**

**Drone cuts off tip of photographer's nose**

**Drone injures Australian triathlete**

**Drone injures bystanders in Virginia crowd**

**Drone flies too close to a news helicopter**

**Drone nearly crashes into Airbus A320**

**Drone caught carrying drugs near the border**

**Drone flies over Bank of America Stadium**

**Drone flies over Comerica Park**

**Drone crashes into Grand Prismatic Spring**

**Drone attacked by hawk**

<http://www.techrepublic.com/article/12-drone-disasters-that-show-why-the-faa-hates-drones/>

**Drone lands in neighbors goat pen**

What the Headlines Will Read

**Drones Improve  
Safety, Reduce  
Pesticide Use, Find  
Missing Hiker,  
Monitor  
Endangered Species,  
etc., etc., etc.,**

Current AECOM Interests in Drone Usage

**Replace Traditional Surveys**

**Monitoring Forest Usage**

**Aid Floodplain Mapping**

**Perform As-built Inspection**

**Detect Gas Leakage**

**Mining Stockpile Volumetric Analysis**

**Bridge Inspections**

**Marketing Materials**

**Pipeline Inspection/Monitoring**

**Well Site Inspection**

**Sea Turtle Nest Evaluation**

**Wetland Restoration Monitoring**

**Transmission Line Inspection**

**Dam Removal Monitoring**



# AECOM Case Study



## – Pulp Mill Waste Monitoring

- Various landfill sites
- Marsh like conditions
- Traditional Survey

## – Ash Pile

- Constant usage
- Potentially unstable
- Volume needed



# AECOM Case Study

## Existing Workflow

- Survey Over 5000 Control Points
  - Multi-person team
  - Multiple days
  - Very hazardous
  - 1cm survey accuracy
  - Generate contours
  - Calculate Change





# AECOM Case Study

## Existing Ground Conditions



# AECOM Case Study

## Alternate Workflow

### – UAS Solution

- Two person team
  - Pilot
  - Observer
- Capture Imagery with a 2.5 cm Ground Sample Distance
- Generate Surface Model
- Create DEM
- Generate Contours
- Calculate Change
- 5cm RMSE x, y, z (AECOM recommended)
  - ASPRS Digital Spec
- 1.25cm RMSE ground control





# AECOM Case Study

## Risks

### – UAS

- Point and Shoot Sensor
  - Canon PowerShot S100
  - 3 – 5 meter GPS accuracy
- No gimbal

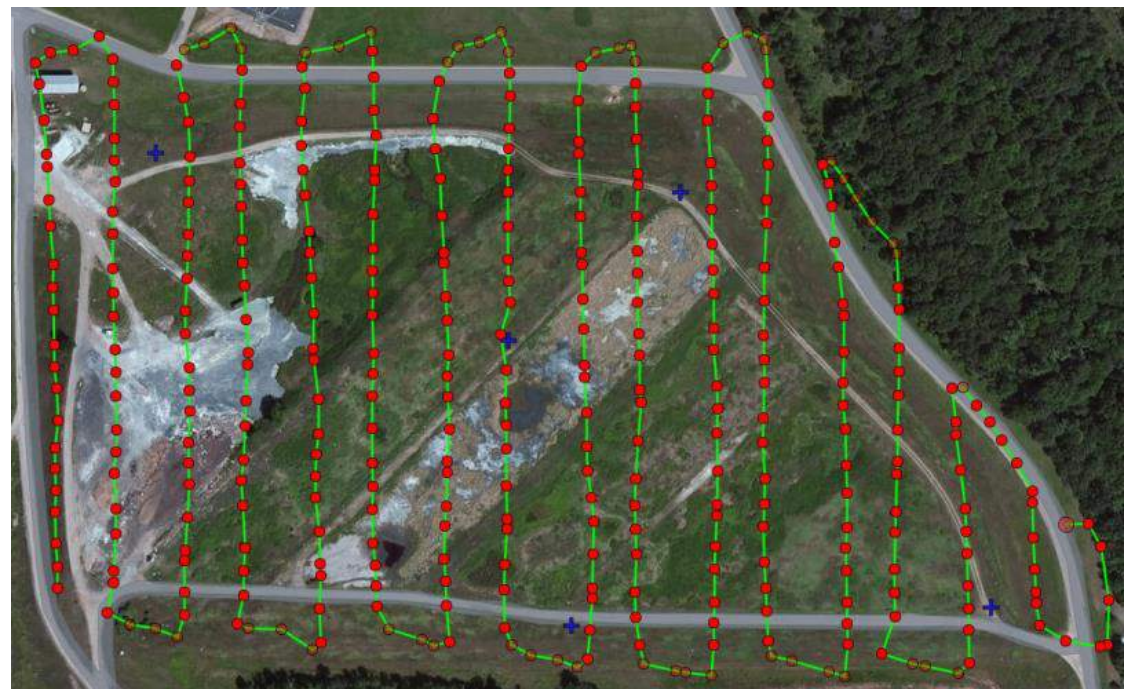
### – Site

- High vegetation in places
- Water



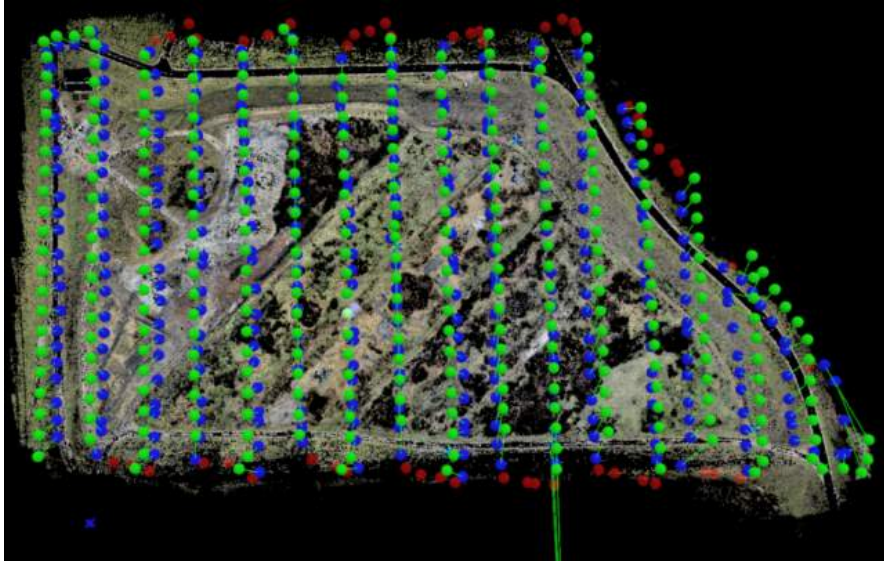
# AECOM Case Study

- 16 ground control points
  - 5 - Area 1
  - 6 - Area 2
  - 5 - Ash Pile
- Area 1
  - 17 flight lines
  - 374 RAW images
  - 1.56 GB of data

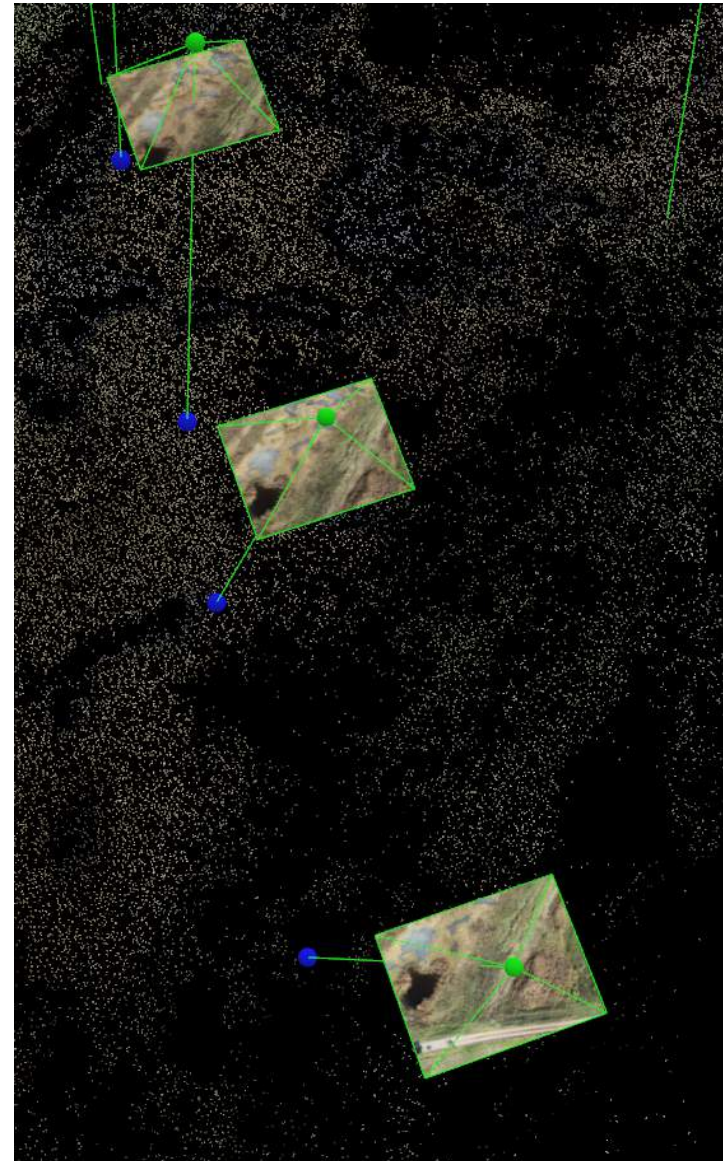
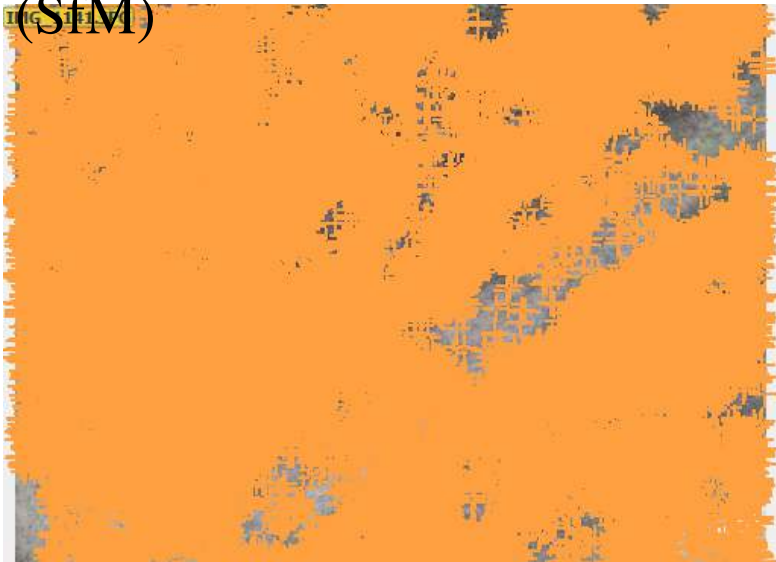




# AECOM Case Study

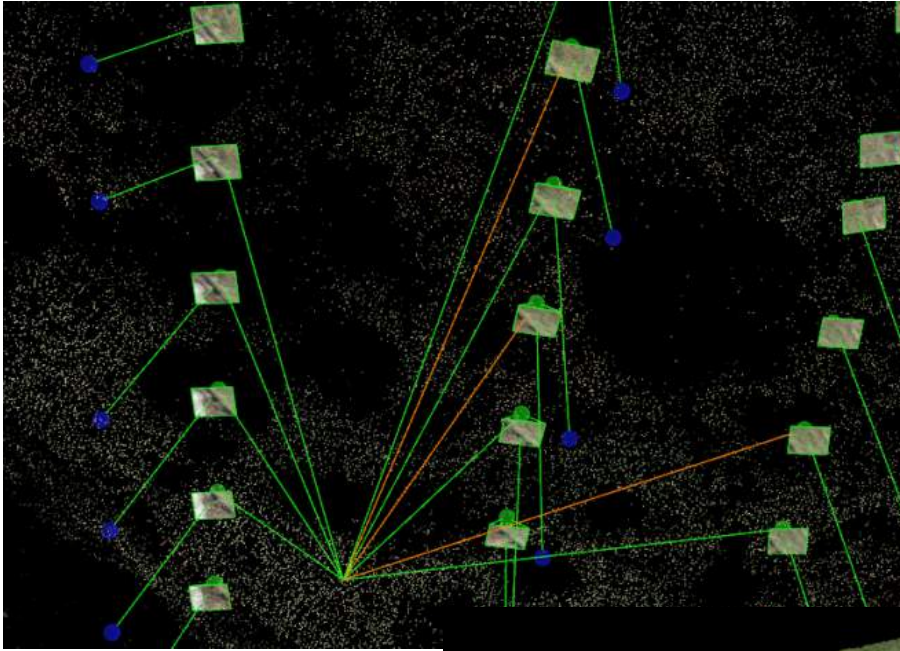


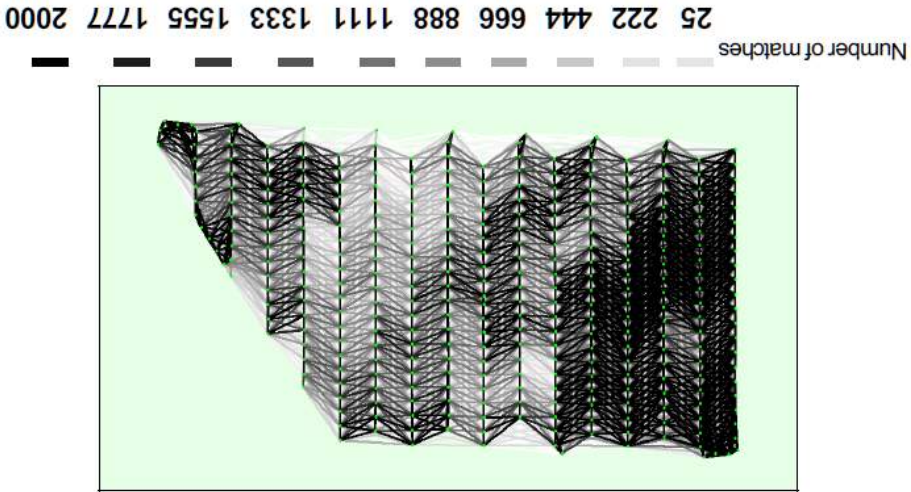
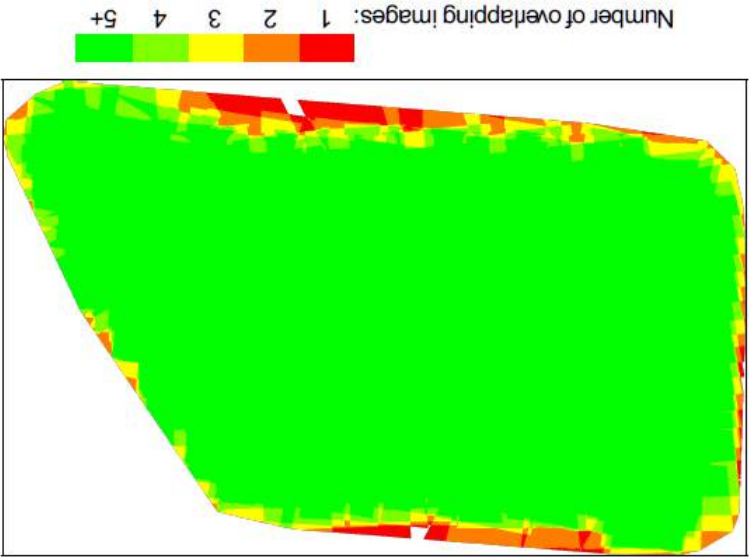
Structure from Motion  
(SfM)





# AECOM Case Study





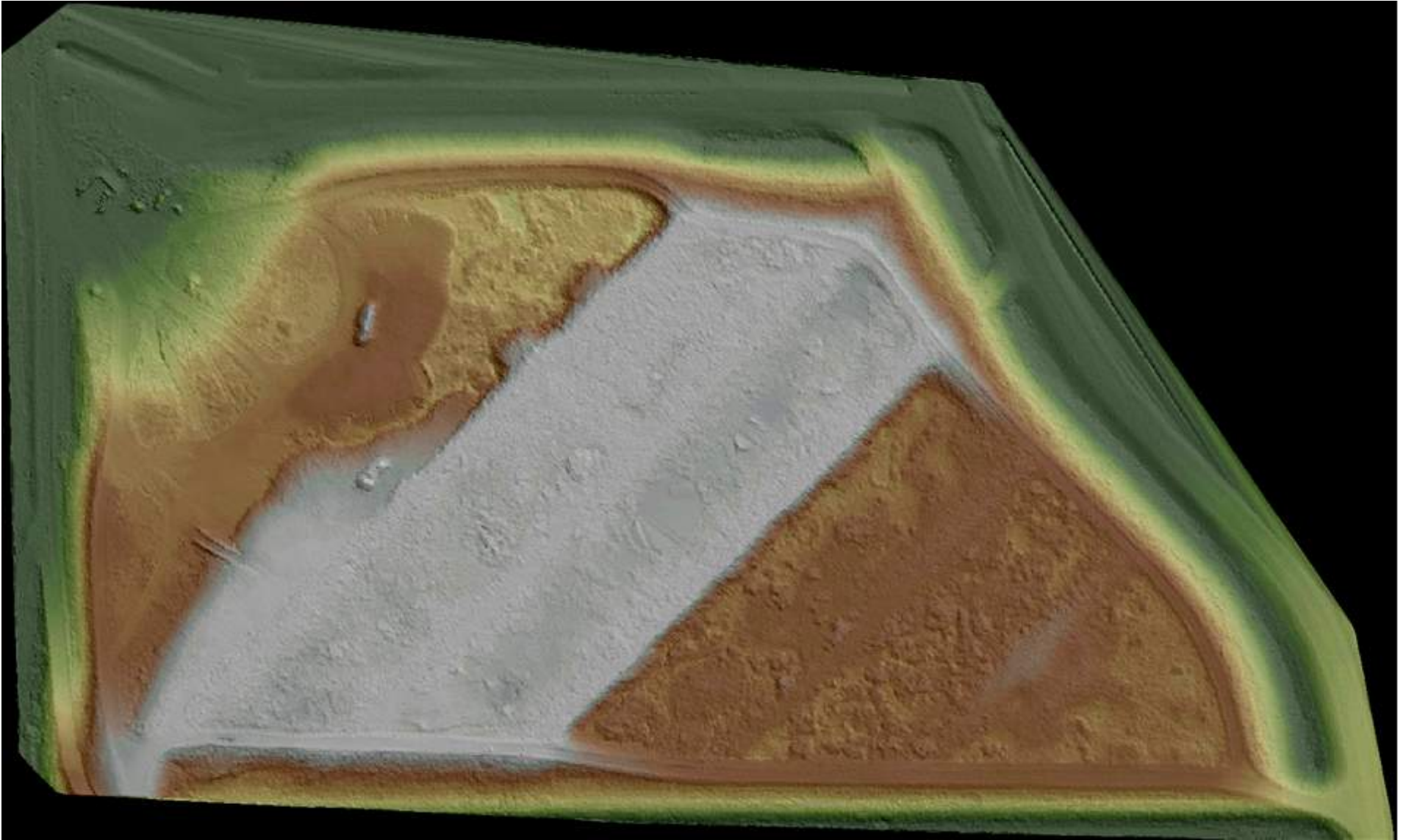


# AECOM Case Study – 2.5cm GSD Orthophoto



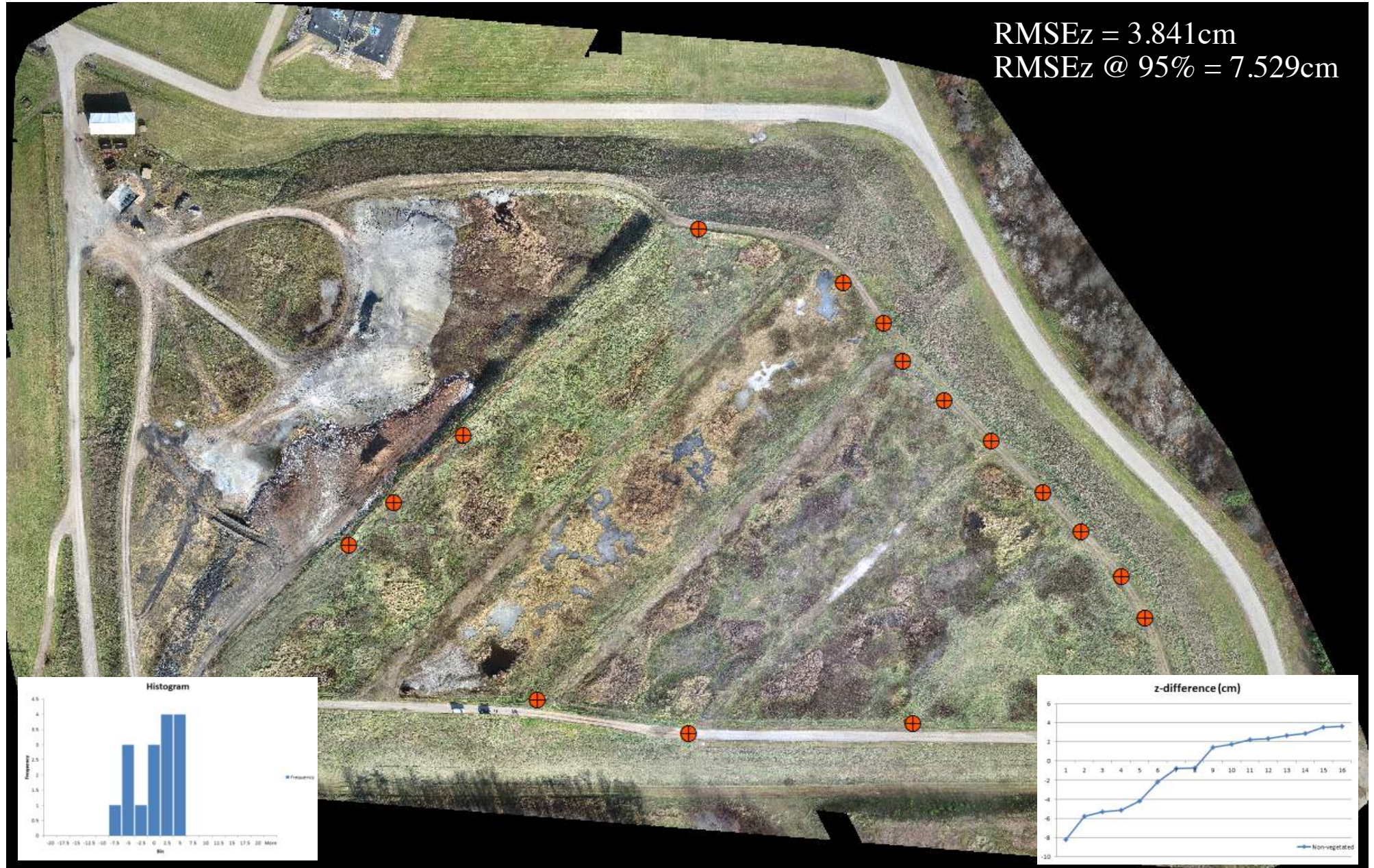


# AECOM Case Study – Digital Surface Model (DSM)





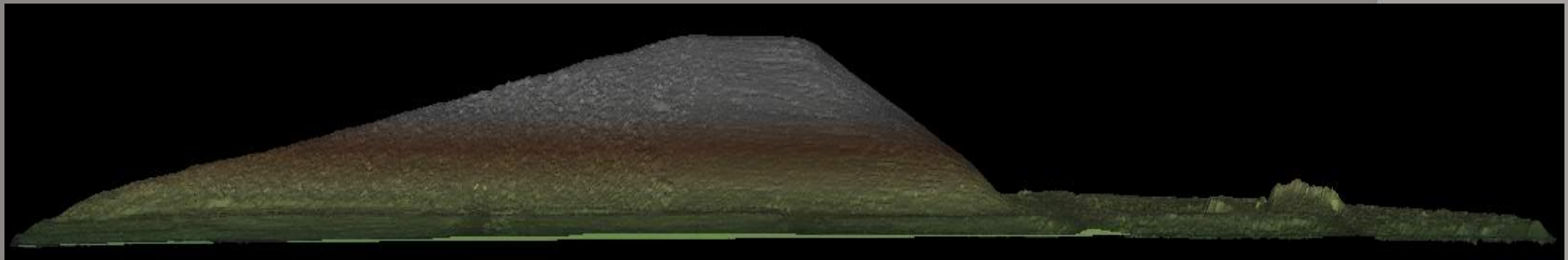
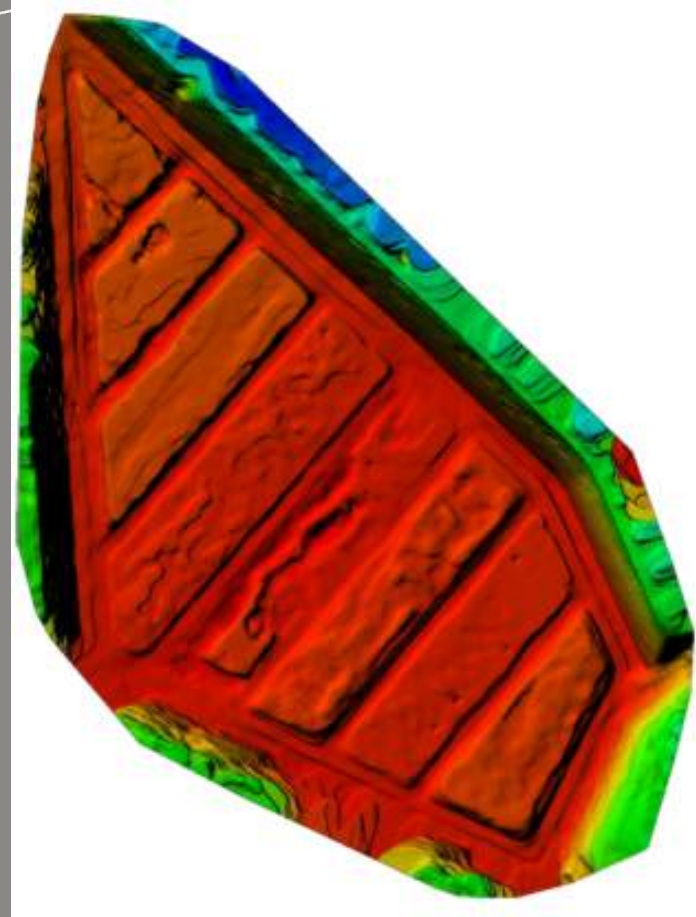
# AECOM Case Study





# Thank You

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**AECOM**